

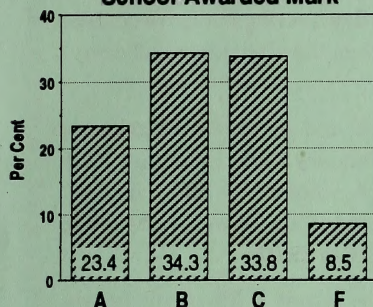
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Biology 30

SEP 28 1992

Diploma Examination Results Examiners' Report for June 1992

School-Awarded Mark

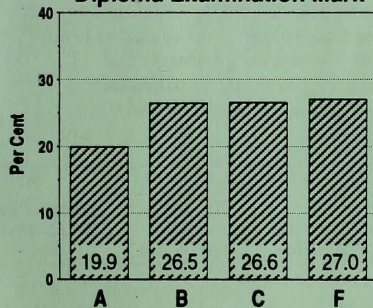


The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the June 1992 administration of the Biology 30 Diploma Examination. This information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. An annual provincial report containing a detailed analysis of the combined January, June, and August results will be available this fall.

Description of the Examination

The Biology 30 Diploma Examination consists of two parts: a multiple-choice section of 70 questions worth 70% and a written-response section of five questions worth 30% of the total examination mark.

Diploma Examination Mark

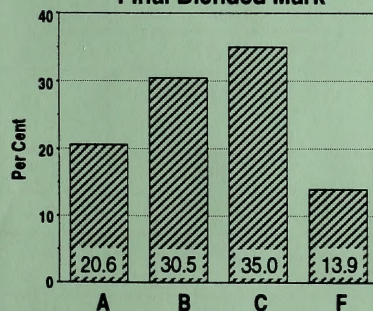


Achievement of Standards

The information reported is based on the final blended marks achieved by 11 470 students who wrote the June 1992 examination. This represents an increase of about 400 students compared to June 1991.

- 86.1% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 20.6% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

Final Blended Mark



Generally, student achievement in Biology 30 for the second semester of 1991-92 was similar to that for the first semester. There was, however, a small decrease (from 88.5 to 86.1) in the percentage of students who achieved the acceptable standard. Many students demonstrated a good understanding of the nature of scientific inquiry; however, a significant number of them had difficulty expressing concepts in the written-response section.

Provincial Averages

- The average school-awarded mark was 67.5%.
- The average diploma examination mark was 62.1%.
- The average final blended mark, representing an equal weighting of the school-awarded mark and the diploma examination mark, was 65.2%.

Results and Examiners' Comments

This examination has a balance of question types and difficulties. It is designed so that students capable of achieving the acceptable standard will obtain a mark of 50% or higher and students capable of achieving the standard of excellence will obtain a mark of 80% or higher. This examination is similar in structure to the January 1992 Biology 30 examination in that it contains five written-response questions, for a total of 30 marks. The maximum value of any one written-response question is 10 marks. The five questions require students to use a variety of thinking skills, all of which go beyond, but are not isolated from, the ability to recall core concepts.

Approximately 12.3% of the students who wrote the examination in June 1992 and received a blended mark had written at least one other Biology 30 Diploma Examination during the January 1991 to January 1992 period. This subpopulation (1 406) achieved an examination average of 59.0%, compared to 62.9% for the population (10 064) whose first writing of a Biology 30 examination was in June 1992. However, the group of students who rewrote increased their examination average score from 47.6% to 59.0%.

Approximately 58.2% of the students who wrote the examination were female. About 71.2% of this female population achieved the acceptable standard on the examination, compared to 75.7% of the male population.

Subtest

When analyzing detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Results are in average raw scores.

Machine scored: 46.6 out of 70

Written response: 15.4 out of 30

Course Content

- Cellular Processes: 5.4 out of 9
- Homeostatic Mechanisms: 2.9 out of 4
- Nutrition and Digestion: 7.2 out of 11
- Body Fluids: 11.0 out of 18
- Breathing, Gas Exchange, and Transport: 4.6 out of 7
- Energy Release: 3.6 out of 5
- The Kidney: 5.6 out of 10
- Regulation of the Internal Environment: 12.6 out of 22
- Voluntary Movement and Body Support: 3.0 out of 4
- Human Reproduction: 6.3 out of 10

Process Skills: 16.5 out of 26

- Multiple-choice questions 3, 5, 6, 12, 15, 16, 17, 20, 23, 32, 35, 40, 44, 47, 48, and 59; and written-response question 1

Cognitive Levels

- Knowledge: 16.2 out of 25
- Comprehension and Application: 33.6 out of 55
- Higher Mental Activities: 12.2 out of 20

Examination Blueprint

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in June 1992 according to these classifications. Numbers with brackets [] indicate written-response questions and those without brackets are multiple-choice questions.

Reporting Category	Questions by Cognitive Level			Examination Emphasis (%)
	Knowledge	Comprehension and Application	Higher Mental Activities	
Cellular Processes	1, 4	2, 3; [2]	5	9
Homeostatic Mechanisms	7	6, 11, 12		4
Nutrition and Digestion	8, 9, 10, 13	14, 15, 16, 18, 19	17, 20	11
Body Fluids	21, 22, 25	23, 24, 26, 27, 28	[1] *	18
Breathing, Gas Exchange, and Transport	29, 30, 31	33, 34	32, 35	7
Energy Release	36, 37	38, 39	40	5
The Kidney	41, 42	43, 44; [5]		10
Regulation of the Internal Environment	49, 51, 54	45, 46, 50, 52, 53, 55, 56; [3], [4]	47, 48	22
Voluntary Movement and Body Support	57	58, 60	59	4
Human Reproduction	61, 65, 66, 69	62, 63, 64, 67, 68	70	10
Examination Emphasis (%)	25	55	20	100

*Written-response question 1 includes concepts from Nutrition and Digestion but is reported only under Body Fluids.

Multiple Choice

Question Key Difficulty*

1	C	82.0
2	D	69.4
3	A	83.9
4	D	67.2
5	C	61.5
6	A	59.8
7	B	76.0
8	B	62.1
9	B	72.5
10	C	83.5
11	A	76.7
12	C	77.3
13	D	61.7
14	C	69.0
15	D	66.5
16	C	68.9
17	A	40.8
18	D	76.8
19	A	45.7
20	A	68.6
21	D	73.3
22	B	45.0
23	C	54.5
24	A	72.8
25	D	65.7
26	B	60.4
27	B	73.6
28	C	52.4
29	B	75.2
30	A	70.3
31	A	56.9
32	B	63.6
33	D	72.6
34	A	61.7
35	A	56.7
36	B	70.8
37	D	57.0
38	C	84.4
39	D	61.7
40	A	81.5
41	A	78.2
42	B	60.5
43	C	81.2
44	A	67.3
45	B	82.6
46	A	75.9
47	D	67.7
48	C	44.3
49	A	38.2
50	B	70.1
51	A	60.8
52	D	61.6
53	C	76.2
54	C	58.8
55	D	60.8
56	A	71.2
57	B	58.6
58	C	70.3
59	B	83.0
60	A	82.9
61	C	63.5
62	D	77.1
63	C	64.1
64	A	70.1
65	A	68.7
66	B	61.3
67	C	71.8
68	A	56.3
69	C	49.0
70	D	50.1

*Difficulty—percentage of students answering the question correctly

Multiple Choice

For a complete breakdown of student responses by alternative for the multiple-choice questions, please refer to the school and jurisdiction reports.

Most students who achieved the acceptable standard demonstrated an understanding of biological concepts by selecting the correct functional description of a human body structure (questions 13, 27, and 62). They also made functional comparisons among body components (questions 6, 41, and 63). Most of these students correctly interpreted simple laboratory tests (questions 11, 12, 15, and 16) and data presented in simple graphs (questions 5, 20, and 44). They sequentially ordered the major steps of physiological processes (questions 30, 43, and 68). They related physiological concepts to common everyday experiences (questions 14, 46, and 50).

Students who achieved the standard of excellence, in addition to fulfilling the expectations identified above, demonstrated the ability to interpret interrelated sets of data presented in complex tables or graphs (questions 17, 23, 35, and 70). They analyzed experimental designs (question 19) and multistep human physiological problems (question 28). They formed correct inferences from extracurricular data (question 48). They identified significant parts of human organs and recognized their functions (questions 22 and 69).

Detailed comments on four questions follow.

Use the following information to answer questions 15 to 17.

In a laboratory investigation, a student was given five different samples of unknown food and water mixtures and one sample containing only distilled water. The student tested the samples and recorded these results:				
Sample Tested	Test Results			
	Benedict's reagent	Iodine	Biuret solution	Sudan IV
I	yellow-green	pale yellow-brown	blue	does not dissolve
II	blue	pale yellow-brown	purple/pink	does not dissolve
III	yellow-orange	pale yellow-brown	blue	does not dissolve
IV	blue	pale yellow-brown	blue	dissolves
V	blue	black	purple/pink	does not dissolve
VI	blue	pale yellow-brown	blue	does not dissolve

16. Bile would assist in the digestion of food found in which sample?

- A. II
- B. III
- C. IV
- D. V

Question 16 required students to recall that bile assists in the digestion of fats. They also had to recall that Sudan IV dissolves in fats and therefore can be used to detect fat in a unknown food sample. This concept-lab integrated question was answered correctly by 96.1% of the students who achieved the standard of excellence (A) on the examination. Of the students who failed to achieve the acceptable standard, 46.0% selected the correct answer and 42.2% selected either distractor B or D. The association of bile with carbohydrate digestion and corresponding carbohydrate identification tests were most frequently confused with bile-assisted fat digestion and its identification. Of the students who obtained a B or C level of achievement on the whole examination, 70.3% selected the correct answer.

17. If a person ate the type of food contained in sample II, there could be an increase in the body's production of

- A. urea
- B. glucose
- C. glycogen
- D. fatty acid

Question 17 required students to recall that Biuret solution is used to test for protein, not starch, sugar, or fat. Logical answers were provided for each of the four foods. However, the connection between urea and protein was more obscure than the connections between the other products (glucose, glycogen, fatty acid) and their corresponding foods. In the context of Biology 30, students generally understood the metabolism of carbohydrates by the small intestine and/or liver better than they understood the metabolism of proteins. Of the students who failed to achieve the acceptable standard, 19.3% selected the correct response and 58.5% selected products of carbohydrate metabolism (distractor B or distractor C). However, of the students who achieved the standard of excellence (A), 81.4% selected the correct answer. Of the students who obtained a B or C level of achievement, 36.5% selected the correct answer.

Use the following table to answer question 23.

Subject	Blood Composition			
	Erythrocytes per μL	Leukocytes per μL	Glucose mg/100mL	Plasma Proteins mg/100 mL
I	2 500 000	10 000	300	8 000
II	5 000 000	3 500	98	9 000
III	7 000 000	7 100	205	8 050
IV	7 000 000	6 900	100	6 000
Normal	5 000 000	7 000	100	8 000

23. Which subject is most likely an untreated diabetic who lives at a relatively high altitude?

- A. I
- B. II
- C. III
- D. IV

Question 23 required students to understand the effects on blood composition of **two** variables: levels of insulin secretion and levels of atmospheric pressure. Students also had to recall the meaning of key terms (erythrocytes, leukocytes). A careful analysis of the data would then provide a plausible combination of quantities that corresponded to the subject's condition. This multistep integrated question was answered correctly by 89.7% of the students who achieved the

standard of excellence (A) on the examination. Many students did not understand the effects of high altitude on blood cell quantities. Of the students who failed to achieve the acceptable standard, 24.7% selected the correct answer, whereas 42.3% selected distractor A. Of the students who obtained a B or C level of achievement, 56.4% selected the correct answer and 27.0% selected distractor A.

31. Human lungs inflate as a result of

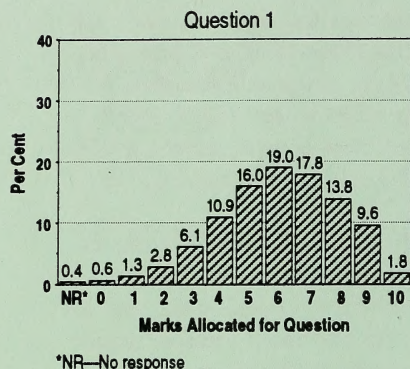
- A. reduced chest cavity pressure
 - B. relaxation of the chest muscles
 - C. reduced volume of the chest cavity
 - D. contraction of the bronchial muscles of the lungs
-

Question 31 required students to distinguish between the effects of muscle relaxation and of contraction on pressure and volume within the chest cavity. They also had to recall the location of the muscles used for inhalation. Many students (18.3%) had the misconception that the lungs inflate because the muscles within them contract (distractor D). Other students (11.0%) did not understand the subtle difference between the primary cause of an event and the complementary conditions that permit that event to occur (distractor B). That is, the increase in chest volume is caused by the contraction of certain muscles but at the same time is permitted by the relaxation of other muscles. Some students (13.8%) did not understand the relationship between inflation and volume (distractor C). Of the students who obtained a B or C level of achievement, 59.8% selected the correct answer. Of the students who achieved the standard of excellence on the examination, 90.0% selected the correct answer.

Written Response

The five questions in the written-response section are designed to assess achievement on six of the 10 content strands for Biology 30. In addition, question 1 required students to analyze and evaluate experimental designs and scientific data. To answer this question, students were expected to draw on their understanding of process skills as developed throughout the Biology 30 course. All five questions required students to apply their understanding of biological concepts to problems in human physiology. The questions required students to analyze contextual material before composing responses. Question 3 in particular required students to integrate several concepts and compose a response that clearly linked the structural and functional characteristics of specialized body parts.

Responses to the written-response section indicated that most students approached the examination seriously and made a commendable effort. All five questions were attempted by 85.6% of the students, and only 0.2% did not attempt any of the five questions. Some students (0.2%) achieved full marks on each question. However, approximately 45.7% of the students obtained less than 15 marks out of the 30 marks for the written-response section. Many students responded to the questions by presenting facts they could recall and did not relate them directly to the problems posed by the question.



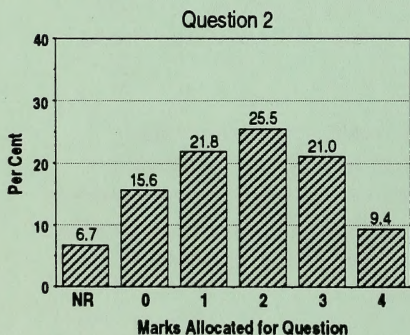
Question 1: Most students demonstrated a good understanding of the processes used in solving problems scientifically. They could interpret the data provided and thereby form relevant conclusions. They were quite aware of the fallacy of using conclusions to develop practical policies when those conclusions are based on limited investigations. Some students did not understand the distinction between manipulated, controlled, and responding variables. Students frequently identified rats as the manipulated variable rather than the type of liquid that was given to the rats.

In part b, some students criticized the experimental design rather than identified the variables that were most likely controlled (fixed). Most students did not respond correctly to part c because they did not recognize that the manipulated variable (type of liquid) was one of the four factors that affected life expectancy. Many did not recognize the cause and effect relationships within a laboratory context. Most students presented valid conclusions for part d. However, many of these conclusions were inconcise or did not relate directly to the hypothesis as given in the context of the question.

Part e was answered well by most students. In part f, many students selected information from the second experiment that did not correspond to the subject of the conclusions they presented in part d. For example, if a student concluded that copper was important in lowering the incidence of heart disease, then the evaluation must relate to copper, not to alcohol. The answers to part g indicated that most students understood the implications of making practical choices based on incomplete data.

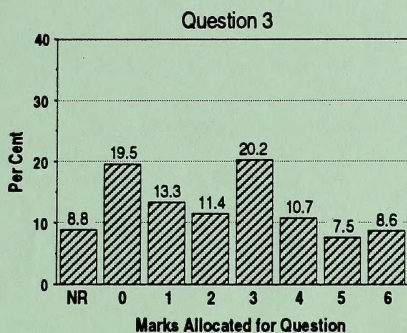
On question 1, there were more students (25.2%) who achieved the standard of excellence than who failed to achieve the acceptable standard (22.0%).

On this 10-mark question, the average mark was 6.02 or 60%.



Question 2: Most students responded to part a of this question by reciting simplistic descriptions (knowledge) of the functions of each organelle. Too many students did not explain (comprehension and application) how the absence of each organelle would affect the processes of erythrocytes. Many students used analogous and/or metaphorical language (nucleus is like a brain; mitochondria are powerhouses) to identify functions. Many students also attributed human characteristics to cells; e.g., red blood cells do not have time or energy to concentrate on their jobs.

For part b, many students identified functions of erythrocytes but did not explain how these functions would be facilitated because of the absence of organelles.



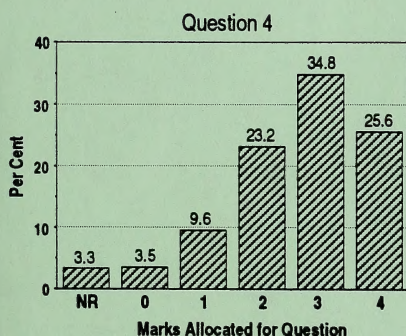
Of the students who failed to achieve the acceptable standard on the examination, 15.1% obtained 2 marks or more for this question. Of the students who achieved the standard of excellence on the examination, 96.1% obtained 2 marks or more.

On this 4-mark question, the average mark was 1.73 or 43%.

Question 3: Approximately 16.1% of the students gave excellent answers to this partially open-ended question, but 28.3% obtained no marks at all. The students (53%) who obtained two marks or less on this question did not analyze the problem correctly. They did not understand the difference between a simple spinal reflex arc and a complex conditioned reflex that involved several regions of the brain. Many students described in detail the sympathetic nervous system rather than identified and described the nervous system pathways that would have been used in the specific situation described in the question. Some students expanded on side issues such as hormonal stimulation, muscle and neuron chemistry, or details of eye structure, without organizing their response around the main theme of “nervous system pathways”.

Most students presented their answers in paragraph form as expected; however, many descriptions were not illustrated by diagrams as suggested. More students could have benefited from preparing a rough draft of their answer on the tear-out pages provided. This step would have facilitated a thoughtfully organized response, which many students did not provide.

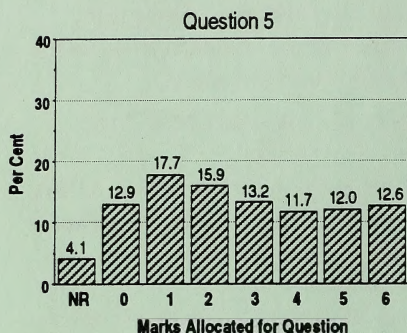
On this 6-mark question, the average mark was 2.29 or 38%.



Question 4: This question provided students the opportunity to select two body systems from which to illustrate the concept of homeostasis. Most students (60.4%) obtained full marks for explaining the results of a severe burn on one system, and at least partial marks for a second system. All four systems listed in the question were represented in the total set of answers.

Most students who selected the excretory system explained homeostatic imbalances in terms of the role of the skin (formation of sweat) rather than in terms of the kidneys (formation of urine) as anticipated. A few students took advantage of the overlap between the circulatory system and the immune system, and therefore gave a similar answer for each. However, answers for the immune system were poorly expressed; e.g., “the immune system has to work harder”. Many students did not differentiate clearly between a change in a system and the effect that change has on homeostasis. This indicates that students have difficulty applying the concept of homeostasis, even though they may be able to define the term.

On this 4-mark question, the average mark was 2.63 or 66%.



Question 5: The students who achieved the standard of excellence on the examination answered this question very well. Only 4.4% of this group obtained less than 3 out of the 6 marks, and 46.3% obtained the full 6 marks. Of the students who failed to achieve the acceptable standard on the examination, 92.1% obtained less than 3 marks and 0.1% obtained the full 6 marks.

Most students answered part a correctly. In part b, most students identified the process (diffusion) but some did not correctly describe the difference in concentration between the patient's blood and the dialyzing fluid. Although many students understood the difference between parts b and c, they demonstrated an inadequate understanding of net movement or described the machine as having some sensing device to monitor levels of solutes in the blood.

In part d, many students referred to erythrocytes as molecules, not cells. Some students provided a definition of semipermeable and thereby simply repeated the information that was provided in the question. Other students answered the question in reference to the body's needs, not in reference to the characteristics of erythrocytes.

On this 6-mark question, the average mark was 2.71 or 45%.

For further information, contact Lowell Hackman or Phill Campbell at the Student Evaluation Branch, 427-2948.

